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COTTON YIELD AND PHYSIOLOGICAL RESPONSE TO POTASSIUM DEFICIENCY: CAN WATER DEFICIT MAKE A DIFFERENCE?

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Abstract

In recent years, numerous studies across the U.S. Cotton Beltwide have focused on the causes, effects, and remediation of mid-season potassium (K) deficiency. However, limited information exists about the impact of water deficit stress and K deficiency on cotton (*Gossypium hirsutum* L.) lint yield and mid-season physiology. Field studies were conducted over three growing seasons in two locations to test our hypothesis that the physiological response to the onset of K deficiency in cotton, dry matter accumulation, and the efficacy of foliar-applied K were directly affected by the plant water status. Eight treatment combinations of well-watered or dryland conditions, high or low soil K, and with or without foliar-applied K were arranged in a split-split plot design with six replications. Growth, dry matter, leaf photosynthesis, and K concentration in above-ground organs were measured at key phenological stages; pinhead square, first flower, first flower + 3 weeks, and first flower + 5 weeks. Final lint yield was determined by mechanical harvest and components of yield were determined by hand harvest from the center two rows of 4-row plots. At early flowering, photosynthesis was reduced by soil K deficiency, particularly under dry conditions. Pre-plant soil-applied K tended to increase photosynthesis and stomatal conductance under either level of water at first flower + 5 weeks. Foliar-applied K increased stomatal conductance under low soil K and well-watered conditions. Total dry matter responded to foliar-applied K under irrigated but not dryland conditions. Lint yield averaged over four growing seasons in two locations tended to respond to soil-applied K only under well-watered conditions. Lint yield increased by 4.5% in response to foliar-applied K under the low versus the high soil K level. Essentially no difference was observed in lint yield response to foliar-applied K under irrigated or dryland conditions. Although the components of leaf gas exchange and total dry matter accumulation didn't respond consistently throughout the boll development period to soil and foliar-applied K, K deficiency appeared to have a more negative impact on lint yield of cotton grown under irrigated as compared to dryland conditions.